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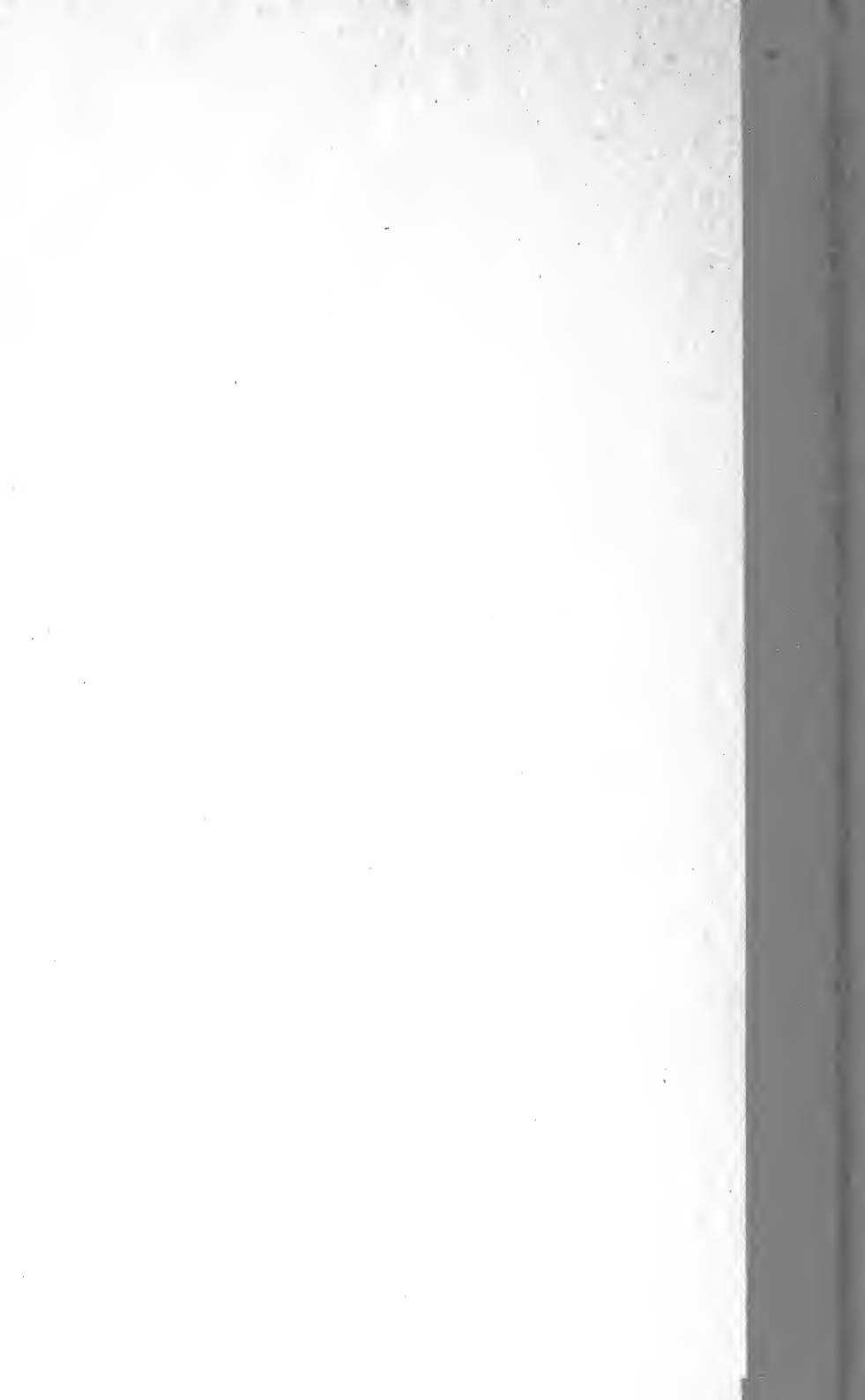
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Title

Imprint



TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE
HUGH S. CUMMING, SURGEON GENERAL

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IN RELATION TO NUTRITION, PHYS-
ICAL DEFECTS, SCHOOL GRADE
AND PHYSICAL TRAINING

BY

E. BLANCHE STERLING

*Acting Assistant Surgeon
United States Public Health Service*

REPRINT No. 779
FROM THE
PUBLIC HEALTH REPORTS

AUGUST 25, 1922

(Pages 2043-2049)



WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

2009-2011

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THE POSTURE OF SCHOOL CHILDREN IN RELATION TO NUTRITION, PHYSICAL DEFECTS, SCHOOL GRADE, AND PHYSICAL TRAINING.¹

By E. BLANCHE STERLING, Acting Assistant Surgeon, United States Public Health Service.

The importance of posture from the standpoint of health has been quite generally recognized since the brilliant exposition of the subject by Goldthwait more than a decade ago. Parents have always been interested in the child's posture from the esthetic point of view, but it is realized that the matter has a far deeper significance than that which relates merely to personal appearance. The positive health value of good posture—to say nothing of its mental effect—is conceded to be great enough to demand careful scientific investigation as to the underlying causes of good and bad posture and their relation to the ordinary conditions of childhood.

The exponents of some of the popular health movements are each prone to consider his particular activity as a panacea for all the bad posture in the world. This is particularly true of a certain type of nutrition worker, or play enthusiast, or specialist in corrective gymnastics. It was felt, however, that to obtain any data of value on the subject of posture it would be necessary to take cognizance not only of those matters but to consider also the hygiene of school life and instruction and the prevalence of common physical defects in childhood.

The present study was made in three elementary schools at Bedford, Ind., comprising children in the first six grades. The number of sixth-grade children is small, owing to the fact that this grade was taught in only one of these schools. The age, sex, grade, nutrition, physical defects, and posture were noted in the case of practically every child in the group studied.

NUTRITION AND POSTURE.

In estimating the nutrition of these children, those who were less than 7 per cent under the existing standards of weight for a given age and height were considered to be well nourished, and were marked "Good." Those 7 per cent or more below these standards were marked "Poor." Those who were underweight at the first weighing but came up to the accepted standard before the close of the school year, and those having "Good" nutrition at the first weighing but sinking to or below the 7 per cent level during the year,

¹ Reprint from the Public Health Reports, vol. 37, No. 34, Aug. 25, 1922, pp. 2043-2049.

were together given an intermediate rating as "Fair." Posture was rated as "Good," "Fair," or "Poor," according to the points usually considered—position of head and shoulders, antero-posterior curves of the spine, flexion of knees, etc.

TABLE I.—*Nutrition and posture rating of 1,115 children in three elementary schools.*

Rating.	Nutrition.	Posture.
	<i>Per cent.</i>	<i>Per cent.</i>
Good.....	58	29
Fair.....	23	40
Poor.....	19	31

Of a total of 1,115 children who were given a rating for posture, 321, or 29 per cent, were classified as good; 442, or 40 per cent, as fair; and 352, or 31 per cent, as poor. Thus it will be seen that the number of children having good posture was slightly less than that of the children having poor posture.

TABLE II.—*Correlation of posture and nutrition.*

Good posture:	<i>Per cent.</i>	Poor posture:	<i>Per cent.</i>
Good nutrition.....	63	Good nutrition.....	54
Poor nutrition.....	14	Poor nutrition.....	23
Good nutrition:		Poor nutrition:	
Good posture.....	31	Good posture.....	22
Poor posture.....	30	Poor posture.....	39

According to those who believe that nutrition is the controlling factor in posture, one would expect to find a majority of these 1,115 children undernourished. On the contrary, 58 per cent of the number never fell to the 7 per cent line during the whole school year, whereas only 19 per cent were at or below this level during the same period. The number of well-nourished children was twice as great as the number of children with good posture. With three times as many well-nourished children as undernourished, the number having good posture, instead of being three times as great, was slightly less than the number having poor posture. Of the 645 children well nourished throughout the year, 31 per cent had good posture and 30 per cent had poor posture. So that a child with good nutrition has a slightly more than even chance of having good posture. If the child's nutrition is poor, his chances of having good posture are less, 22 per cent of the 212 children underweight throughout the year having good posture and 39 per cent having poor posture.

Of those children who reach the good-posture grade, the well-nourished constitute 63 per cent of the total number. It is to be noted, however, that 14 per cent of these good-posture children were underweight throughout the year, so that it is quite possible for an underweight child to have good posture. On the other hand, among the children with poor posture, almost twice as many were well nourished as were undernourished—54 per cent to 23 per cent.

On the whole, it seems evident that while good nutrition is a contributory factor to good posture, it is almost as likely to be found with poor posture. Poor nutrition is less likely to be found with good posture than is good nutrition with poor posture.

PHYSICAL DEFECTS AND POSTURE.

An investigation of the relation of physical defects to posture brought out some interesting facts.

TABLE III.—*Correlation of physical defects with posture.*

Defect.	Number of children.	Posture.	
		Good.	Poor.
		<i>Per cent.</i>	<i>Per cent.</i>
Teeth alone.....	430	34	23
Eyes alone and with teeth.....	126	26	37
Adenoids alone and with teeth.....	35	14	43
Tonsils alone and with teeth.....	114	26	36
Adenoids alone or with eyes, teeth, or both.....	39	15	41
Tonsils alone or with eyes or teeth or both.....	157	25	39
Adenoids and tonsils alone or with eyes or teeth or both.....	188	23	43
Adenoids or tonsils or both, alone, or with eyes, teeth, or both.....	384	23	41

Defective teeth, which have been blamed for most of the ills which flesh is heir to, apparently can be given a comparatively clean bill of health in the case of posture. Of 430 children having this defect alone, 34 per cent had good posture and 23 per cent had poor posture. Since the number having good posture is almost one and one-half times as great as those with poor posture, defective teeth can not be considered a factor of importance in the production of poor posture.

The number of children having eye defects alone (37) is too small to furnish any conclusive evidence as to the effect of this defect on posture. When, however, to this number is added those having a combination of eye and teeth defects, and eliminating the latter as unimportant, the figures show 37 per cent with poor posture as against 26 per cent with good posture. Hence, eye defects must be taken into consideration in studying the question of the posture of school children. This evidence supports the opinions long held by orthopedists.

Defects of the nose and throat seem to have an important effect on the posture of the child. Of 384 children having adenoids or enlarged or diseased tonsils, or both, either alone or in combination with eyes, or teeth, or both, 41 per cent had poor posture and only 23 per cent had good posture. Of 306 children in whom were found a combination of poor posture and physical defects, 52 per cent had adenoids, enlarged or diseased tonsils, or a combination of these defects.

It is interesting to note that of those children showing poor posture not accompanied by physical defects the well nourished throughout

the year were twice as numerous as the ill nourished throughout the year, and also twice as many as those underweight at the beginning of the year but who came up to the accepted standards before the close of school. This is another bit of evidence that poor posture is by no means pathognomonic of poor nutrition.

SCHOOL LIFE AND POSTURE.

In order to inquire into the relation of school conditions to the posture of the pupils, a study was made of posture in the various grades. It seems scarcely fair to include the sixth grade, because of the small number of children of that grade included in the study, and hence it is omitted in the grade studies. It will be seen from the accompanying table that the general direction of the good posture curve is downward from the first grade, and that of the poor posture curve is upward.

TABLE IV.—*Posture by grades.*

Grade.	Number of pupils.	Posture.		
		Good.	Fair.	Poor.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
1.....	358	34	40	26
2.....	197	29	45	26
3.....	195	28	37	35
4.....	201	24	38	38
5.....	125	29	33	38

The difference between the highest and lowest good posture ratings is 10 per cent, whereas the difference between the highest and lowest poor posture rating is 12 per cent. The fall in good posture is seen to be slightly less than the rise in poor posture. These figures are encouraging, because, with adequate health supervision, physical training, and good hygienic conditions, it ought not to be difficult to convert a 12 per cent deficit into a good posture surplus. The school system studied, while having many excellent features, did not have an adequate system of physical training for its elementary schools, and the pupils at that time had not been furnished with adjustable seats and desks.

SCHOOL GRADE AND NUTRITION.

In order to discover whether the increase in poor posture and the decrease in good posture in the higher grades was accompanied by an increase in malnutrition in those grades, a grade-nutrition study was made. It would be manifestly unfair in a school-grade-nutrition study to use the results of the first fall weighing as a basis for the calculation of the malnutrition for that grade. The child's weight when he enters school in the fall is largely influenced by his

manner of life during the long summer vacation, when he is not directly under the school's influence. In view of this fact, the age weight-height index was obtained from the spring weighing.

TABLE V.—*Percentage of underweight pupils by grade.*

	Per cent.
Grade 1.....	23
Grade 2.....	17
Grade 3.....	19
Grade 4.....	21
Grade 5.....	23

It will be seen from the table that there was a rather sharp fall in the amount of underweight from the first to the second grade, and then a gradual rise until the percentage of underweight pupils in the fifth grade was exactly the same as that in the first grade. The difference between the amount of malnutrition in the second grade and the fifth grade was 6 per cent. Again it is seen that the correlation between nutrition and posture is not a perfect one.

POSTURE AND PHYSICAL EXERCISE.

Unfortunately the school system studied furnished no real test of the effect of various forms of physical exercise. No trained teacher of physical education was connected with the elementary schools. The pupils were supposed to engage in supervised play during recess, but there was no supervision other than that of the regular class teacher. Without training in games and the supervision of play activities, her presence on the playground in most cases had no practical value, as far as real playground work was concerned. Occasionally a teacher's enthusiasm helped to make up for her lack of training, but this was the exception rather than the rule.

In two of the schools (L. and S.), in addition to this more or less desultory play, the teacher taught the pupils some free standing gymnastics. In L. school these were conducted to music, in generally poor form, in a hall in the center of the building, without adequate ventilation. At S. school rather vigorous, snappy, free-standing exercises were given without music, frequently in the open air when the weather permitted.

A comparative study of posture in these three schools will give a fair idea of the value of such physical training as the pupils received.

TABLE VI.—*Posture, nutrition, and physical defects in three elementary schools.*

School.	Posture.			Nutrition.			Physical defects.		
	Good.	Fair.	Poor.	Good.	Fair.	Poor.	Eyes.	Adenoids.	Tonsils.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
S.....	39	33	28	56	26	18	20	20	32
C.....	24	42	34	63	19	18	21	18	29
L.....	21	45	34	53	25	22	23	24	34

Table VI shows that the posture rating in S. school was decidedly better than that in either of the other schools. In order to eliminate any source of error in estimating the value of the physical training, the nutrition and physical defects have been included in the same table for the purpose of comparison. Since the nutrition in S. school is lower than that in C. school and the combined percentage of physical defects is higher, the superiority of S. over C. can not be due to either of these factors.

The posture ratings of C. and L. are very nearly equal, though C., with better nutrition and fewer physical defects, should naturally rate higher. It does not seem likely that the poor type of gymnastics at the L. school accounts for this difference. Whether their play is more worth while or the fact that the school has fewer pupils to handle is responsible for the condition can not be definitely stated.

Though it is felt that the effect of play on posture did not have a fair test in the elementary schools, some interesting work in basket ball was carried on in the high school. The Bedford High School team proved itself to be the second best basket-ball team in the State of Indiana, which is fairly conclusive evidence of the thorough training it received. It is worthy of note that even a cursory inspection of these boys showed some examples of fine posture.

CONCLUSIONS.

The posture of school children can not be said to depend entirely, or even chiefly, on any one condition. The following conclusions seem to be confirmed by the facts noted in this study:

1. While good nutrition is a contributing factor to good posture, it is by no means an indispensable condition.

2. Defective vision, adenoids, and bad tonsils tend to have an unfavorable effect on a child's posture.

3. When the hygienic conditions in a school are not of the best, and health measures are inadequate, there is a moderate decrease of good posture and increase of poor posture from the first to the fifth grade, inclusive. This is not believed to be a necessary accompaniment of school life, but a condition that may be easily remedied by cooperation of the health and educational authorities.

4. In planning exercise with a view to the promotion of good posture, it is suggested that setting-up exercises be simple and vigorous and play full of energy and vim. Formless, jellyfish gymnastics, or stupid, silly games, played half-heartedly, have little place in the proper physical development of the growing child.

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